

The U.S. DOE Microreactor Program

Performing Research and Development to Enable Microreactor Development, Deployment and Commercialization

The U.S. Department of Energy (DOE) Microreactor Program supports research and development (R&D) of technologies related to the development, demonstration and deployment of very small, factory fabricated, transportable reactors to provide power and heat for decentralized generation in civilian, industrial and defense energy sectors.

Led by Idaho National Laboratory (INL), the program conducts both fundamental and applied R&D to reduce the risks associated with new technology performance and manufacturing readiness of microreactors. The intent of the program is to ensure that microreactor concepts can be developed, licensed and deployed by commercial entities to meet specific use case requirements.

The program coordinates work and activities across participating laboratories, universities and industry as well as other DOE programs. National laboratories participating in the Microreactor Program are INL, Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory and Sandia National Laboratories.

What are the benefits of the Microreactor Program?

This program performs unique microreactor-related activities that can directly reduce the technology risks and uncertainties of near-term designs and next-generation microreactor applications and concepts. Because microreactor designs under development are novel and possess unique technology features—such as autonomous operation, inherent safety and full transportability—there is a significant need for R&D support. The DOE national laboratory complex is uniquely positioned to fulfill those needs to support industry and other

What are microreactors?

Microreactors are a class of very small modular reactors targeted for nonconventional nuclear markets. These include remote communities, mining sites and remote defense bases, as well as applications such as backup generation for power plants, humanitarian assistance and disaster relief missions. Such applications may be uniquely addressed by this new class of innovative nuclear reactors.

stakeholders. This program performs R&D in areas pertaining specifically to civilian commercial microreactors, though recognizing synergies with ongoing defense microreactor R&D efforts.

What are the key objectives of the Microreactor Program?

The key objectives of this program are:

Meet critical crosscutting R&D needs of existing developers that require national laboratory, university and industry expertise and capabilities.

Develop R&D infrastructure to support design, demonstration, regulatory and safety-related tests and to collect data to validate modeling and simulation tools.

Develop advanced technologies for next generation microreactors, for example, more efficient heat exchange systems.

Enable microreactor applications, including district heat, hydrogen production and defense applications.

U.S. DOE Microreactor Program Vision

Through crosscutting R&D and technology demonstration support, by 2025 the Microreactor Program will:

- 🎯 **Achieve** technological breakthroughs for key features of microreactors
- 🎯 **Enable** successful maturations of multiple domestic commercial microreactor technologies
- 🎯 **Empower** initial demonstrations of the next advanced reactors in the United States

What is the scope of the Microreactor Program?

The Microreactor Program performs R&D to support the development, demonstration and deployment in the following areas:

System Integration & Analyses

Seek understanding of the microreactor design space by investigating innovative microreactor concepts, performing regulatory research to support the regulatory basis for microreactor deployments, and performing R&D to increase the technical readiness for microreactor deployments.

Activities include:

Integrated modeling and simulation of microreactors

Establish the areas of applicability and gaps in experimental data needed to improve the performance prediction capabilities of existing modeling and simulation tools, specifically those developed by the program Nuclear Energy Advanced Modeling and Simulation (NEAMS).

Techno-economic analysis

Perform economic analysis and market studies to guide the development of the reactor designs to guide microreactor developers to meet economic targets for competitiveness.

Licensing and regulatory

Perform research to support licensing pathways for microreactor development and work with industry, academia and the U.S. Nuclear Regulatory Commission to provide data and information on issues related to those pathways.

Technology Maturation

Mature key technologies used for the design and development of microreactors, including:

High-Temperature Moderator Materials: Focus near-term on the development of yttrium hydride. Other moderator materials may be considered in the future.

Core, Heat Exchanger, and Power Conversion Integration and Testing: Research and test the nonnuclear components required for a microreactor to advance technology and increase our understanding of system performance.

Structural Material Manufacturing and Testing: Establish better understanding of the performance of microreactor core and reactor structures under extreme conditions and detailed manufacturing processes.

Advanced Heat Removal: Investigate unique challenges associated with transporting heat from the core due to the compact footprint, radiation field, transportability and high temperatures presented by the inherent features of microreactors.

Instrumentation and Sensors: Perform research for instrumentation for the nonnuclear test bed, sensors for structural health, and autonomous sensing and control.

Demonstration Capabilities

Perform nuclear and nonnuclear testing and support of activities needed to support microreactor demonstrations.

Microreactor AGile Nonnuclear Experimental Testbed (MAGNET)

Develop an integrated thermal test capability to simulate core thermal behavior, heat pipe, and primary integrated electrically heated thermal heat exchanger performance and passive decay heat removal to support verification of modeling and simulation tools.

Microreactor Applications Research, Validation and Evaluation (MARVEL)

Develop a platform to support development and demonstration of the integration of end use technologies with a small-scale nuclear microreactor.



This conceptual rendering shows MAGNET with other components at INL's Integrated Energy Systems (IES) Laboratory.

For more information

DOE Program Manager

Tom Sowinski 301.903.0112 | Thomas.Sowinski@nuclear.energy.gov

National Technical Director

Jess Gehin, Ph.D. 208.526.3486 | Jess.Gehin@inl.gov



U.S. DEPARTMENT OF
ENERGY | Office of
NUCLEAR ENERGY